

What is claimed is:

1. Circuitry comprising:
 a power supply;
 a power amplifier having a power supply input coupled to both a first power supply branch including a switch mode power converter and to a second power supply branch including a transistor, power conversion efficiency of first power supply branch being higher than that of the second power supply branch at a relatively low output power level of the power amplifier and being lower than that of the second power supply branch at a relatively high output power level; and
 a control circuit for selecting one of the power supply branches depending on a desired output power level.
2. The apparatus of Claim 1, wherein the power amplifier is an RF power amplifier.
3. The apparatus of Claim 2, wherein the RF power amplifier is operated in compression.
4. The apparatus of Claim 2, wherein the RF power amplifier is operated in switch mode.
5. The apparatus of Claim 2, wherein the RF power amplifier is provided with separate amplitude and phase paths.
6. The apparatus of Claim 5, comprising a phase modulator coupled to an RF input of the power amplifier and controlled by said control circuit.
7. The apparatus of Claim 5, wherein the control circuit includes an amplitude modulator.

8. The apparatus of Claim 7, wherein the transistor performs both power control and amplitude modulation under control of the control circuit.

9. The apparatus of Claim 7, wherein the switch mode power converter performs both power control and amplitude modulation under control of the control circuit.

10. The apparatus of Claim 7, wherein the first power supply branch further comprises a second transistor, in series with the switch mode power converter.

11. The apparatus of Claim 10, wherein the switch mode power converter performs power control under control of the control circuit, and the second transistor performs amplitude modulation under control of the control circuit.

12. The apparatus of Claim 10, comprising a saturation detector coupled to the second transistor and to the control circuit.

13. The apparatus of Claim 1, comprising at least a third power supply branch including a further switch mode power converter.

14. The apparatus of Claim 13, wherein said switch mode power converter and said further switch mode power converter produce different fixed output voltages.

15. The apparatus of Claim 14, wherein at least one of said switch mode power converter and said further switch mode power converter are of the switched capacitor type.

16. Circuitry comprising:
a power supply;

a power amplifier having a power supply input;

a transistor coupled in series with a switch mode power converter, the switch mode power converter being coupled to the power supply, and the transistor producing a supply voltage coupled to said power supply input;

a control circuit for controlling the switch mode power converter;

and

a saturation detection circuit coupled to the transistor and to the control circuit, the control circuit operating in response to the saturation detection circuit such that saturation of the transistor is counter-acted.

17. The apparatus of Claim 16, wherein the power amplifier is an RF power amplifier.

18. The apparatus of Claim 17, wherein the RF power amplifier is provided with separate amplitude and phase paths.

19. The apparatus of Claim 18, comprising a phase modulator coupled to an RF input of the power amplifier.

20. The apparatus of Claim 18, wherein transistor is part of an amplitude modulator.

21. The apparatus of Claim 20, wherein an envelope signal is applied to the amplitude modulator and to the control circuit.

22. The apparatus of Claim 21, wherein the control circuit controls the switch mode power supply to produce a voltage including a nominal AM offset.

23. The apparatus of Claim 22, wherein the control circuit, when a saturation detection signal is active, increases the nominal AM offset.

24. The apparatus of Claim 20, wherein the control circuit and the amplitude modulator, an envelope signal is applied to the amplitude modulator only.

25. The apparatus of Claim 24, wherein the control circuit performs the following operations at the Nyquist rate or greater in relation to an envelope signal:

causing an output of the switch mode power supply to be reduced until a saturation detection signal becomes active; and
causing the output of the switch mode power supply to be increased by some amount such that the saturation detection signal becomes inactive.

26. A method of power supply processing to achieve efficient, low-distortion operation of an RF power amplifier circuit including a switch mode power supply coupled to an amplitude modulator, comprising:

controlling the switch mode power supply to vary a power supply output thereof;
detecting saturation of the amplitude modulator; and
controlling the switch mode power supply to counter-act saturation of the amplitude modulator.

27. The apparatus of Claim 26, comprising controlling the switch mode power supply to reduce a voltage drop across the amplitude modulator as long as saturation of the amplitude modulator is not detected.